

Evidence of decline for *Bufo boreas* and *Rana luteiventris* in and around the northern Great Basin, western USA

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Revisiting historical sites for patch-associated fauna can provide a relatively fast assessment of species status in a region. Between 2000 and 2003 we repeatedly surveyed historically documented sites for two amphibian species of concern in the northern Great Basin: the western toad (*Bufo boreas*) and the Columbia spotted frog (*Rana luteiventris*). We estimate that *B. boreas* occupies 49.5 % (34.1-65.0 %) of 34 Historical sites and that *R. luteiventris* occupies 52.9 % (43.5-62.3 %) of its 30 Historical sites. *B. boreas* was more likely to be detected at Historical sites that were human-altered whereas *R. luteiventris* was more likely to be detected at sites that had deeper water than other sites in our study. *B. boreas* was detected at three of 41 (7.3 %) Proximal sites (located near Historical sites) whereas *R. luteiventris* was detected at six of 16 (37.5 %) Proximal sites. *B. boreas* was detected at one of 187 Randomly selected sites, and *R. luteiventris* at three sites. Given that the number of Historical sites available for resurveys was small, our results should be interpreted with caution. Moreover, a species can shift its distribution away from Historical sites due to habitat succession or metapopulation dynamics without necessarily declining. We suggest that there is sufficient evidence to conclude that *B. boreas* and *R. luteiventris* have declined in and around the northern Great Basin. Comparatively high occupancy of Proximal Sites by *R. luteiventris* suggests this species may not have declined as much as has *B. boreas* in our study region.

INTRODUCTION

Declines in amphibian populations are a global problem and their causes are often complex (ADAMS, 1999; KILGICKER et al., 2001). An essential step in understanding the causes of decline and, perhaps, slowing or halting this process is to document the regional extent of declines. Historical site records, such as those stored in museums or documented in the published literature, are a valuable resource for gauging changes in occupancy patterns of fauna in general (RIMNICK et al., 1994) and have often been used to assess the status of

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amphibians (CORN et al., 1989, ROSS et al., 1995, DROST & FELLERS, 1996, FISHER & SHAFFER, 1996; DAVIDSON et al., 2001; SKELLY et al., 2002)

The Pacific Northwest region of the United States has been a focal area of research on amphibian decline; however, broad-scale studies of amphibian species status remain rare in the region. The scope of most research completed in the region has focused on suspected causal agents such as UVB, disease, and introduced species (e.g. BLAUSTEIN et al., 1994a-b, ADAMS et al., 2001; PEARL et al., 2004). Declines of several anurans in the west have been attributed to changes in land use patterns, specifically, habitat destruction and the use of agrochemicals (DAVIDSON et al., 2001; DAVIDSON et al., 2002). The western toad (*Bufo boreas*) has experienced dramatic declines in other parts of its range (CORN et al., 1989; ROSS et al., 1995; DROST & FELLERS, 1996, VERTUCCI & CORN, 1996; FISHER & SHAFFER, 1996), but its status is unknown in the northern Great Basin, an arid region in the intermountain northwest of the United States with large public land holdings. Likewise, the Columbia spotted frog (*Rana luteiventris*) is thought to be declining in portions of its range (PATLA, 1997; REASER, 1997) and is a Candidate Species under the US Endangered Species Act (ANONYMOUS, 1997). To determine the status of these amphibians in and around the northern Great Basin, we documented the occupancy of three types of sites by *B. boreas* and *R. luteiventris*: historically occupied sites (Historical sites), sites located near the Historical sites (Proximal sites), and randomly selected sites from across the region (Random sites). We also analyzed how habitat characteristics and certain potential stressors affect amphibian occurrence at Historical sites.

MATERIALS AND METHODS

We developed a list of Historical sites from museum records, published accounts, and field notes of local biologists. Records ranged in date from 1939 to 1999 but any record with an observation prior to the years of this study could be included as a Historical site. Most Historical sites we selected ($n = 34$ for *B. boreas*, $n = 18$ for *R. luteiventris*) were located in Oregon east of the Cascade Range but we also included a small number of *R. luteiventris* Historical sites ($n = 12$) in northeastern Nevada. The overall study area including both Oregon and Nevada ranged from 45°57'35"N, 117°28'27" W in the north to 40°19'16"N, 116°05'07" W in the south, and from 42°41'14"N, 117°01'29" W in the east to 43°54'31"N, 121°45'37" W in the west. Sites ranged in elevation from 406 to 2,256 meters. We gave priority to Historical sites that had records of breeding (i.e., eggs, larvae or newly metamorphosed individuals) but we also included some adult-only sites to increase our sample size. Aside from status at known Historical locations, to determine how rare each species is in the Upper Great Basin habitat of southeastern Oregon, we also surveyed sites in the vicinity of the Historical sites (usually within 25 km). When possible, these Proximal sites were located within the same watershed or were physically similar to the Historical sites. Finally, occurrence data from 187 Randomly selected sites in the southeastern quarter of Oregon were also included in the study. Random sites were drawn using a spatially balanced design (general randomized stratified design with unequal probability sampling, STEVENS & OLSEN, 2004) that provided a widely spaced random selection of fifth field hydrologic units (HUCs). Within the selected HUCs, we

surveyed all accessible ponds and streams located on US Department of the Interior lands. We visited sites indicated on GIS maps developed by the US Bureau of Land Management (BLM) and 7.5 minute US Geological Survey topographic maps as well as sites incidentally encountered in the field (less than 5 % of total number visited).

The region covered by our surveys roughly coincides with, but in some cases exceeds, the northern Great Basin. Some Oregon Historical and Proximal sites were located on the east slope of the Cascades and in the Blue Mountains ecoregion around the margins of the northern Great Basin. Our surveys focused on lands managed by the BLM and therefore excluded higher elevation lands managed by the US Forest Service (USFS) in northern and central Nevada where REASER (1997) has previously documented a decline of *R. luteiventris*.

In 2000-2003, we surveyed sites between April and September when amphibians are most likely to be active. All sites in Oregon ($n = 52$) were surveyed in more than one year and a few ($n = 14$) were surveyed more than once during a single field season. Sites in Nevada ($n = 12$) were surveyed once. We excluded data from sites that were dry. We used a standard visual encounter survey method including wading and dipnetting to detect amphibians (OLSON et al., 1997). At each site, we recorded all amphibian taxa and life history stages as well as 10 site and habitat characteristics. Our protocol called for two workers to slowly search all habitats within one meter of standing water. The workers turned any cover objects by hand and used a long-handled dip net to sweep through open water, aquatic vegetation, or along the substrate. At larger lentic sites only a partial survey was completed. If the historical record included specific locality details about a large site, that portion was searched. Otherwise, we searched areas with appropriate pool and vegetative cover characteristic for amphibian habitat (expert opinion).

STATISTICAL ANALYSIS

Because detection of amphibians at ponds is expected to be less than 100 % (OLSON et al., 1997), we used the program PRESENCE (MACKENZIE et al., 2002) to estimate the proportion of Historical sites that are currently occupied in addition to reporting the proportion of sites where we detected the species (the naïve occupancy rate). PRESENCE is designed to estimate the proportion of sites occupied (ψ) by a species of interest while incorporating an estimate of species detectability (p). There are two possible explanations of a non-detection result at a surveyed site, either the species was not present at the site or we failed to detect it even though it was present. By visiting a site multiple times, we were able to estimate species detectability and produce an unbiased estimate of occupancy. We treated all searches as if they were conducted during a single season. This violates an assumption of PRESENCE that occupancy does not change during the study. This violation may have caused us to underestimate detectability by treating some true absences as false absences. Underestimating detectability would cause us to overestimate occupancy so any declines may be more severe than our estimates indicate.

PRESENCE also allows for the inclusion of covariate data. We constructed models to estimate occupancy using the response variable Detection along with one survey covariate and nine site covariates that were selected from the larger suite of characteristics collected

Table 1. Variables used in models to describe detection data for *Bufo boreas* and *Rana luteiventris*. Class refers to the variable type (response variable, survey or site covariate) as well as the category it represents (habitat or stressor).

Variable	Class	Description
Detection	response	binomial: presence or non-detection of species at site
Season	survey	binomial: indicates if detection in spring (April-May) differs from summer (June-September)
Record Type	site	binomial: historical evidence of breeding or not
Elevation	site/habitat	continuous: elevation of site in meters
Cover	site/habitat	continuous: per cent emergent vegetation at site averaged across visits
Shallows	site/habitat	continuous: per cent shallows (< 0.5 m) at site averaged across visits
Wetland Type	site/habitat	binomial: site was pond/lake/spring or river/stream
Origin	site/habitat	binomial: naturally occurring or human-altered/human-made
Grazing	site/stressor	binomial: evidence of cattle grazing at site or not
Distance from Road	site/stressor	binomial: site was less than or greater than 100 m from nearest road
Fish	site/stressor	binomial: fish of any species detected at site or not

during each Historical site survey. The response variable in all cases was coded 1 if the species was detected during the given survey and 0 if it was not. We limited the suite of covariates to 10 due to our small sample sizes (tab. 1). The survey covariate Season indicated whether the site was surveyed in spring (April-May) or summer (June-September). This was included because we suspected that detectability was lower in the summer than in the spring. One site characteristic, Record Type, indicated whether the site historically had a record of breeding or non-breeding. Besides the survey covariate and Record Type, we included variables that, as indicated by previous work (HADDEN & WESTBROOKE, 1996; AKER, 1998; VOS & CHARDON, 1998; SEMLITSCH, 2000; PILLIOD & PETERSON, 2001), might be related to amphibian decline. Grazing (whether or not the site was used by cattle), Distance to Road (whether or not the site was less than 100 m from the nearest road) and Fish presence (whether or not fish were detected). We also included variables that are often important to amphibian biology: Elevation, Cover (percentage of the site covered with emergent vegetation), Shallows (percentage of the site with water less than 0.5 m in depth), Origin (whether the site appeared to be natural or if it was human-altered/human-made) and Wetland Type (lentic or lotic). We screened all 10 of the predictor variables for collinearity. If a pair of variables had a Pearson correlation above 0.70, one must be eliminated (NASH & BRADFORD, 2001); however, none of our variable pairs broke this rule. We also screened for multiple collinearity by building a simple linear regression model with detection as the response variable. In the collinearity diagnostics, a variance inflation factor above 10 for any of the covariates would have indicated a strong linear relationship with one or more of the other covariates and that variable would be dropped (SPSS 9.0, SPSS Inc., Chicago, IL, USA). None of the covariates needed to be dropped. We then built a model predicting occupancy for each species using PRESENCE to conduct a forward stepwise procedure. At each step of the stepwise selection process, we added the variable that resulted in the best model based on the small sample version of

Akaike's Information Criterion (AIC_c). AIC_c is a measure of the information content of a model relative to the number of parameters in the model (BURNHAM & ANDERSON, 2002). We stopped adding covariates when none decreased the AIC_c score by greater than 2.0 following BURNHAM & ANDERSON (2002). Our estimate of site occupancy was based on the model that resulted from this procedure. We report the estimated proportion of sites occupied ($\hat{y}$) and a 95 % confidence interval.

As we progressed through the stepwise regression, each model was tested for goodness-of-fit using the Pearson chi-square test statistic and a parametric bootstrap method available in PRESENCE. If a model had failed the goodness-of-fit test (none failed) we would have adjusted our model selection procedures following MACKENZIE & BAILEY (in press).

Finally, we present raw detection data for Proximal and Random sites to provide a more complete depiction of *B. boreas* and *R. luteiventris* status in the region.

RESULTS

Bufo boreas

We detected *B. boreas* at 11 of 34 Historical sites yielding a naive occupancy rate of 32.4 % (fig. 1-2). Using PRESENCE, we estimated the proportion of sites occupied to be 49.5 % (34.1–65.0 %) and the detection probability for a single survey to be 0.3204. Nineteen of our 34 Historical records were pre-1990; we found *B. boreas* at four of these sites (21.1 %). At 15 more recently recorded sites (1990–1999), occupancy was higher (46.7 %). In eastern Oregon, we detected *B. boreas* at three of 41 (7.3 %) Proximal sites and at one of 187 Random sites (0.5 %).

Origin was the only covariate selected using stepwise regression (tab. 2). The odds of *B. boreas* occupying an altered site were 9.2 times greater than for naturally occurring sites. Season did not affect detection probability for this species.

Rana luteiventris

We detected *R. luteiventris* at 12 of 18 (66.7 %) Historical sites in Oregon (fig. 3–4). In Nevada, we found *R. luteiventris* at only one of 12 (8 %) Historical sites that had water (six sites were dry) but sites in Nevada were only visited once. Overall, we detected *R. luteiventris* at 43.3 % of Historical sites. Using PRESENCE, we estimated the proportion of sites occupied to be 52.9 % (43.5–62.3 %) and the detection probability for a single survey to be 0.73. Because sites in Nevada were only visited once, we had to assume that detection probabilities were similar in the two states. We found *R. luteiventris* at four of the eight (50 %) Historical sites that were documented before 1990. At 22 more recently recorded sites (1990–1999), the rate of detection was slightly higher (59.1 %). We detected *R. luteiventris* at six of 16 Proximal sites (37.5 %) and three of 187 Random sites (1.6 %).

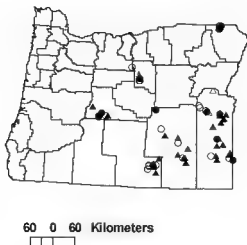


Fig 1 Historical sites surveyed for *Bufo boreas* ($n = 34$) in 2000-2003. Circles indicate Historical sites. Triangles represent Proximal Sites (filled present, empty, *B. boreas* not detected)

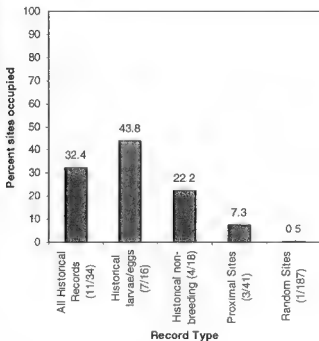


Fig 2 - Occupancy data for *Bufo boreas* at sites in eastern Oregon. In addition to Proximal and Random sites, the data are separated into 3 categories based on evidence of breeding from the Historical record

Table 2. - Models evaluated for best fit to the *Bufo boreas* detection data using the single season model of PRESENCE. k : number of parameters; n : sample size (number of sites). (.) indicates the null condition where no covariates are included. Site covariates are associated with the occupancy of *B. boreas* at the site (ψ) Survey covariates are associated with *B. boreas* detectability (p) ψ -hat is the estimate of site occupancy for *B. boreas* under the tested model along with standard error. The best model for each step is indicated with bold type.

Model	k	n	AIC	AIC _c	ψ -hat (SE)
Step 1					
ψ (.) p (.)	2	34	90.4466	90.8337	0.4672 (0.1434)
ψ (.) p (Season)	3	34	91.7882	92.5882	0.4659 (0.1436)
ψ (Record Type) p (.)	3	34	90.984	91.784	0.4606 (0.1406)
ψ (Elevation) p (.)	3	34	92.3288	93.1288	0.4714 (0.1473)
ψ (Shallows) p (.)	3	34	91.5037	92.3037	0.4564 (0.1349)
ψ (Cover) p (.)	3	34	91.3205	92.1205	0.4711 (0.1454)
ψ (Wetland Type) p (.)	3	34	92.2078	93.0078	0.4615 (0.1399)
ψ (Grazing) p (.)	3	34	91.4929	92.2929	0.4760 (0.1474)
ψ (Distance from Road) p (.)	3	34	92.411	93.211	0.4690 (0.1448)
ψ (Origin) p(.)	3	34	88.3268	89.1268	0.4953 (0.1542)
ψ (Fish) p (.)	3	34	92.4284	93.2284	0.49698 (0.1460)

In the stepwise regression analysis, Shallows and Season were the covariates identified as components of the best model describing site occupancy by *R. luteiventris* (tab. 3). For each increase in Shallows of 10 %, the odds of *R. luteiventris* occurring at a site decreased by a factor of 1.8. The detection probability of *R. luteiventris* was higher in spring (April and May)

DISCUSSION

Large-scale, multi-year studies of amphibian status are time and resource intensive. As a result, few have been completed (CORN et al., 1989; FISHER & SHAFFER, 1996; DAVIDSON et al., 2001; SKELLY et al., 2002). Our study was designed to offer a first assessment of species status for *B. boreas* and *R. luteiventris* at sites spread over a large geographic area (eastern Oregon and northeastern Nevada). We found evidence that both *B. boreas* and *R. luteiventris* have declined in eastern Oregon. We failed to detect both species at a large proportion of older Historical records, which might be expected due to a greater likelihood of habitat change at a particular site. We also failed to detect both species at many of the Historical sites known to be occupied within the last 10 years.

Table 3 – Models evaluated for best fit to the *Rana luteiventris* detection data using the single season model of PRESENCE. k : number of parameters; n : sample size (number of sites) () indicates the null condition where no covariates are included. Site covariates are associated with the occupancy of *R. luteiventris* at the site (ψ). Survey covariates are associated with *R. luteiventris* detectability (p) ψ -hat is the estimate of site occupancy for *R. luteiventris* under the tested model along with standard error. The best model for each step is indicated with bold type

Model	k	n	AIC	AIC _c	ψ -hat (SE)
Step 1					
ψ () p ()	2	30	88.1578	88.60224	0.6254 (0.1088)
ψ () p(Season)	3	30	83.9262	84.84928	0.5444 (0.1147)
ψ (Record Type) p ()	3	30	89.8828	90.80588	0.5107 (0.1100)
ψ (Elevation) p ()	3	30	88.5946	89.51768	0.5094 (0.1069)
ψ (Shallows) p ()	3	30	84.6093	85.53238	0.5186 (0.0935)
ψ (Cover) p ()	3	30	90.1527	91.07578	0.5229 (0.1114)
ψ (Wetland Type) p ()	3	30	88.2465	89.16958	0.5167 (0.1052)
ψ (Grazing) p ()	3	30	89.0036	89.92668	0.5292 (0.1108)
ψ (Distance from Road) p ()	3	30	85.9227	86.84578	0.5049 (0.0975)
ψ (Origin) p ()	3	30	89.7491	90.67218	0.5262 (0.1114)
ψ (Fish) p ()	3	30	87.8985	88.82158	0.4967 (0.1012)
Step 2					
ψ (Shallows) p(Season)	4	30	80.5017	82.1017	0.5293 (0.0941)
ψ (Record Type) p (Season)	4	30	85.8223	87.4223	0.5332 (0.1167)
ψ (Elevation) p (Season)	4	30	84.8601	86.4601	0.5219 (0.1102)
ψ (Cover) p (Season)	4	30	85.9163	87.5163	0.5444 (0.1147)
ψ (Wetland Type) p (Season)	4	30	84.0302	85.6302	0.5364 (0.1078)
ψ (Grazing) p (Season)	4	30	84.7084	86.3084	0.5506 (0.1126)
ψ (Distance from Road) p (Season)	4	30	81.8528	83.4528	0.5205 (0.0996)
ψ (Origin) p (Season)	4	30	85.4464	87.0464	0.5493 (0.1146)
ψ (Fish) p (Season)	4	30	84.1889	85.7889	0.5075 (0.1045)

Although these results seem to demonstrate declines, several factors complicate their interpretation. First, the period of time when our visits were made (2000-2003) coincided with a drought that progressed in severity from moderate to extreme across the region (National Oceanic and Atmospheric Administration National Drought Mitigation Center, unpublished data). This drought was more extreme in the northern Great Basin region of our study and we noted a lower *B. boreas* naive occupancy rate in this region (25 %) than at sites overall (32 %). Individuals in breeding populations of *B. boreas* occasionally skip a year or two of breeding, possibly due to a decrease in foraging opportunities that impact egg production (OLSON, 1991). In several amphibian species, skipping of the breeding season has been attributed to



Fig 3 – Historical sites surveyed for *Rana luteiventris* ($n = 30$) in 2000-2003. Circles indicate Historical sites. Triangles represent Proximal Sites (filled, present, empty *R. luteiventris* not detected).

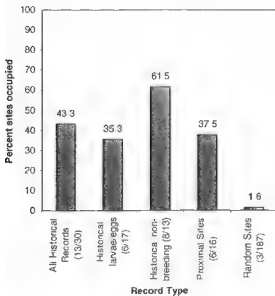


Fig 4 – Occupancy data for *Rana luteiventris* at sites in eastern Oregon and northeastern Nevada. The larvae/eggs category represents Historical sites where evidence of breeding was found. The non-breeding category represents Historical sites where only adults or juveniles were recorded.

drought (PECHMANN et al., 1991; BABBITT & TANNER, 2000; TRENHAM et al., 2000; MARSH & TRENHAM, 2001). However, the fact that most of our sites were visited for three seasons suggests that *B. boreas* might be permanently absent. Because we excluded Historical sites that were dry from our analysis, our evidence of decline is conservative. Including those sites would have caused our results to indicate a more severe decline.

A second factor that could complicate interpretation of these data is the variation in the type of historical record that we used. Although many of our sites had multiple *B. boreas* records, half were based on adult and/or juvenile records rather than direct evidence of breeding. Record Type was not selected in the final model for either species using a stepwise process so we conclude that the stage of the specimen was not strongly related to the odds of current occurrence.

A final complicating factor is that historical site revisitation studies are inherently biased toward detecting declines rather than expansions (SKELLY et al., 2002). In some cases, a population lost from a historical site may be replaced by a new population due to metapopulation dynamics, successional changes in the suitability of other sites on the landscape, or other processes (SKELLY et al., 1999). We have no way to estimate how often population replacement might have occurred. However, available information suggests that both species have high site fidelity (OLSON, 1991; REASER, 1996; ENGLE, 2001; PILLIOD et al., 2002). Observations of colonization are rare but such events may be episodic. For example, following a large wildfire in Glacier National Park, small numbers of *B. boreas* colonized twelve previously unused breeding sites within two years (Hossack & Corn, unpublished data) and both species can colonize newly constructed ponds (C. Pearl, unpublished data). *B. boreas* extensively colonized new ponds on Mount St. Helens following the 1980 eruption (LOVETT, 2000). The fact that a high proportion of *R. lateralis* Proximal sites were occupied might suggest that declines in this species are less severe than in *B. boreas* despite similar estimates of occupancy for Historical sites.

Whereas our analysis indicates that some *B. boreas* population losses have occurred, these declines do not appear to be as severe as declines described in other regions in the western USA. For example, CORN et al. (1989) documented *B. boreas* at 10 of 59 (17 %) historical sites in Wyoming and Colorado. DROST & FELLERS (1996) found *B. boreas* at only one of eight (12.5 %) historical sites in and around Yosemite National Park, California. These results can be compared with our naive estimate of 32 % occupancy based on multiple surveys over multiple years. CORN et al. (1989) also visited most sites over multiple years but DROST & FELLERS (1996) only visited sites during one year. The higher occupancy rate in our study may indicate that losses around the Great Basin have not been as severe as those in other parts of *B. boreas*' range. Comparable data on *R. lateralis* status are available from at least three sources. PATLA (1997) reported a dramatic decline in a single large population at Yellowstone National Park, Wyoming, that occurred between the 1950s and 1990s. In southwestern Idaho, *R. lateralis* was missing from five of 16 (31 %) known sites in 2001 (ENGLE, 2002). REASER (1997) documented *R. lateralis* at only 50 % of the historical sites she surveyed in Nevada. The low *R. lateralis* occupancy rate (1 of 12 wet sites) at our BLM sites in northeastern Nevada suggests declines might be more pronounced in lower-elevation habitats than in the higher elevation sites surveyed by REASER (1997) in Nevada. We recommend return surveys at Nevada sites we were only able to survey once.

Potential causes of decline of *B. boreas* in our region could be related to natural processes of succession or human induced habitat change. Grazing by cattle is one of the most extensive uses of public lands in the western United States (BELSKY et al., 1999) and many reservoirs were built on public lands as an improvement specifically for grazing in the northern Great Basin. Amphibians do use these man-made reservoirs but the specific amphibian habitat use patterns across the region are not known prior to the building of the reservoirs. The fact that our final model showed a tendency for *B. boreas* to occupy human-altered sites at least indicates that cattle reservoirs and other human-altered sites provide some suitable habitat for the persistence of the species.

Rana luteiventris may be experiencing a less severe decline than *B. boreas*. We base this conclusion on the fact that this species was present at 37.5 % of the Proximal sites. This is a high rate of occupancy for sites that were only selected for surveys based on their proximity and similarity to Historical sites. Declines appeared more severe in Nevada but the lack of repeat surveys and Proximal sites limits our ability to interpret these data. The significance of the covariate Shallows is likely related to *R. luteiventris*' need for permanent water. The inclusion of the covariate Season can probably be attributed to the Nevada data because these sites were all visited in the summer and we detected *R. luteiventris* at only one site. *R. luteiventris* in nearby southwestern Idaho populations has been infected with a chytrid fungus and other disease organisms in recent years that might be in part responsible for population declines observed at sites in that state (DREW, 2003). In addition, non-native fish have a strong negative impact on site occupancy by *R. luteiventris* in eastern Washington (AKER, 1998) and Idaho (PILLIOD & PETERSON, 2001).

In summary, our study provides evidence of at least a moderate decline in *B. boreas* and *R. luteiventris* in and around the northern Great Basin. Though none of the variables we examined clearly explained the potential declines of these species the overall patterns we observed warrant further research.

RÉSUMÉ

Le réexamen de sites dont la faune a été étudiée dans le passé (sites historiques) peut fournir relativement rapidement des informations sur le statut des populations animales dans une région. Entre 2000 et 2003 nous avons à plusieurs reprises étudié les populations d'amphibiens de sites historiques. Les deux espèces étudiées, *Bufo boreas* et *Rana luteiventris*, sont menacées dans la région du nord du Grand Bassin. Nous estimons que *B. boreas* occupe 49,5 % (34,1-65,0 %) de 34 sites historiques et *R. luteiventris* 52,9 % (43,5-62,3 %) de 30 sites historiques. *B. boreas* s'est avéré plus présent dans les sites historiques altérés par l'homme, tandis que *R. luteiventris* était plus abondante dans les sites à eau profonde que dans les autres sites étudiés. *B. boreas* a été trouvé dans trois sites voisins des sites historiques sur 41 (7,3 %), tandis que *R. luteiventris* a été trouvée dans six sites de ce type sur 16 (37,5 %). *B. boreas* a été trouvé dans un site sur 187 sélectionnés au hasard; et *R. luteiventris* dans trois d'entre eux. Nos résultats doivent être interprétés avec prudence car le nombre de sites historiques disponibles pour réexamen était faible. De plus, la répartition d'une espèce peut s'éloigner des sites historiques en raison de changements dans les habitats ou de la dynamique de ses métapopu-

lations sans pour autant décliner. Nos résultats suggèrent que *B. boreas* et *R. luteiventris* ont décliné dans la partie nord du Grand Bassin et alentours. La relative abondance de *R. luteiventris* dans les sites voisins des sites historiques semble indiquer que cette espèce pourrait ne pas avoir autant décliné que *B. boreas* dans la région d'étude.

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